

Title: Novel Preparation and Magneto Chemical Characterization of Nano-Particle Mixed Alcohol Catalysts

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## Abstract

We have produced Co, Cu, and Fe nano-particles by Laser-induced solution deposition (LISD) as evidenced by TEM investigations. Sizes of the nano-particles created are in the order of 5 nm. The LISD system could generate nano-particles in quantities only in the order of a milligram. This may be mainly due to the limited photo induced reactions taking place on the surface of the solutions. We have designed experiments to use drop flow technique with LISD for nano-particle deposition on micro-reactors. Preliminary work has been done on Co and Fe thin film deposited micro-reactors. We are also investigating the catalytic properties of nano-particles of FeO and CoO prepared by ball milling and dispersed into sol-gel prepared alumina granules.

We have continued our investigation of catalytic reactions of Cu, Co, Fe, Cu/Co, Cu/Fe and Co/Fe on alumina support. The metal oxides were first reduced with hydrogen and used for the conversion of CO/H<sub>2</sub>. The surface area of the catalysts has been determined by nitrogen dissorption. They are in the range of 200-300 m<sup>2</sup>/g. Cu, Co, Fe, Co/Fe, Cu/Co and Cu/Fe showed increasing order of catalytic activity for CO/H<sub>2</sub> conversion. We are also studying catalytic conversion rates for CO<sub>2</sub>/H<sub>2</sub> and CO/CO<sub>2</sub>/H<sub>2</sub> mixtures using these catalysts. Our investigations of Co and Fe thin film deposited micro-reactors showed higher CO/H<sub>2</sub> conversion for Fe compared to Co.

We have used vibrating sample magnetometer (VSM) to study the magnetic characteristics of as prepared, reduced, post-reaction catalysts. Comparative study of the ferromagnetic component of these samples gives the reduction efficiency and the changes in metal centers during catalytic reactions. Magnetic studies of post-reaction Co and Fe micro-reactors show that more carbide formation occurs for iron compared to cobalt.

## Publications and Presentations:

1. "Nanostructured Particulate Catalytic Materials", Baiyun Tong, Qun Gu, Upali Siriwardane, Seetala V. Naidu, Akundi N. Murty, and Zhenchen Zhong. Second Louisiana Materials Conference, August 25-26, 2001, Baton Rouge, LA.
2. "Novel Fabrication of Magnetic Oxides", Z.C. Zhong, R.H. Cheng, J. Bosley and P. A. Dowben. Second Louisiana Materials Conference, August 25-26, 2001, Baton Rouge, LA.

3. "Preparation and Characterization of Nanostructured Particulate Catalytic Materials", Baiyun Tong, Upali Siriwardane, Seetala, V. Naidu, Akundi N. Murty, and Zhenchen Zhong. Materials Research Society (MRS) Annual Fall Meeting (2001), November 25 - December 1, 2001, Boston, MA.
4. "Annual Report on the Research of Nanostructured Catalytic Materials", Z. C. Zhong Semi-Annual Review Meeting for NSF-EPSCoR, January 25, 2002, New Orleans, LA.
5. "Preparation and Characterization of Nanostructured Granular Support and Particles and Catalytic Materials", Z. C. Zhong, S. V. Naidu, A. K. Murty and U. Siriwardane, Annual Meeting on Energy Research and HBCE Project, July 26-27, 2001, Pittsburgh, PA.
6. "Al-Ni-Y Nanocrystalline Composite Divertrified by Amorphous Alloys", Z. C. Zhong, 2001 APS Annual March Meeting, March 12-16, 2001, Seattle, Washington.
7. "The activities and accomplishments done by LA Tech and GSU JFAP Team", Z. C. Zhong, 2001 JFAP Spring Workshop, May 12, 2001, Baton Rouge, LA.
8. "Magnetic Oxides prepared by LISD and LCVD", Z. C. Zhong, R. H. Cheng, and P. A. Dowbe, Materials Research Society (MRS) Annual Fall Meeting (2001), November 25-December 1, 2001, Boston, MA.
9. "Nanofabrication and Nanostructured Matrials by a novel Laser Chemical Processing", Z. C. Zhong, 2002 APS Annual March Meeting, Indianapolis, IN, March 17-22, 2002.
10. "Novel Preparation and Characterization of Nanostructured Particulate Catalytic Materials by Laser-Induced Solution Deposition (LISD)," Baiyun Tong, Upali Siriwardane, Seetala V. Naidu, Akundi N. Murty, and Zhenchen Zhong, SPIE 47th Annual Meeting - Materials and Nanotechnology, July 12-15, Seattle, Washington.

**Students Worked on the Project:**

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